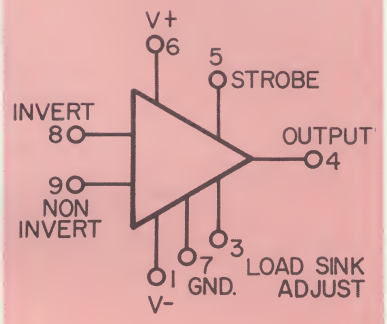
VOLTAGE COMPARATOR

SIGNETICS MONOLITHIC LINEAR CIRCUITS

SE518G
SE518K

JUNE 1967

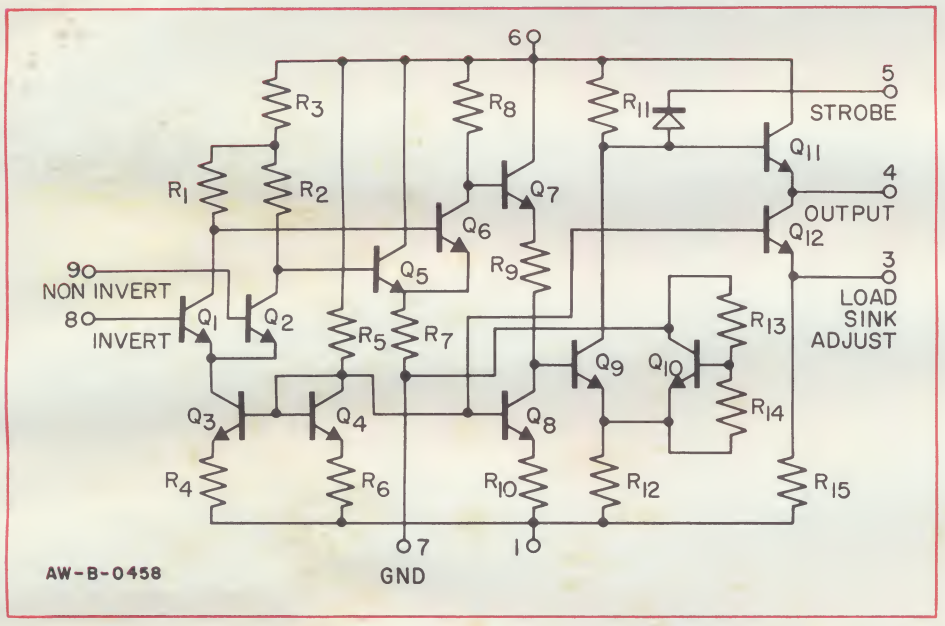
The Signetics SE518 is a medium-gain, high-frequency differential amplifier fabricated within a monolithic silicon substrate by planar and eptiaxial techniques. It is designed for voltage comparator, sense amplifier and general broadband amplifier applications. Its superior current sinking and current sourcing capabilities make it ideal for driving digital circuitry. The SE518 is designed to operate over the full MIL temperature range of -55°C to +125°C and is guaranteed to meet or exceed all environmental requirements of MIL-S-19500D and MIL-STD-750.



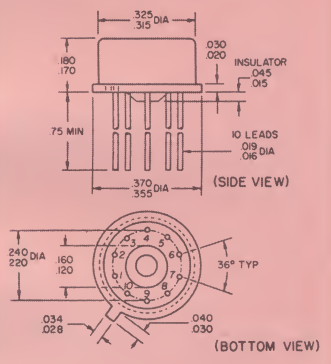
FEATURES

- STROBE CONTROL
- ADJUSTABLE CURRENT SINK
- RESPONSE TIME = 55ns
- INPUT OFFSET VOLTAGE = 1.0mV
- OPEN LOOP GAIN = 2100
- OUTPUT IMPEDANCE = 50Ω
- BANDWIDTH = 5.0MHz

CIRCUIT SCHEMATIC

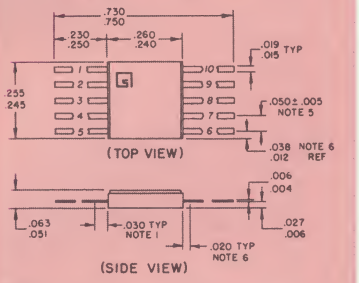


K-PACKAGE (TO-100)



G-PACKAGE (TO-91)

(MODULAR GLASS-KOVAR)



NOTES:
(1) Recommended minimum offset before lead bend.
(2) All leads weldable and solderable.
(3) Pin 1 internally connected to case.
(4) All dimensions in inches.
(5) Tolerances are non-cumulative.
(6) Lead spacing dimensions apply to this area only.
(7) Signetics symbol on flat package locates lead No. 1.

ABSOLUTE MAXIMUM RATINGS

VOLTAGE APPLIED (Positive)	+8.0V
VOLTAGE APPLIED (Negative)	-4.0V
VOLTAGE APPLIED (Input)	±5.0V
POWER CONSUMPTION	300mW
POWER SUPPLY CURRENT RATING	-25mA
OUTPUT SOURCE CURRENT	20mA
STORAGE TEMPERATURE	-65°C to +150°C
OPERATING TEMPERATURE	-55°C to +125°C

Maximum ratings are limiting values above which serviceability may be impaired.

SIGNETICS CORPORATION • 811 EAST ARQUES AVENUE, SUNNYVALE CALIFORNIA • TEL: (408) 739-7700 • TWX: (910) 339-9220

ELECTRICAL CHARACTERISTICS (NOTE 1) Standard Conditions: V+ = +6.0V, V– = –3.0V

ACCEPTANCE TEST SUB-GROUP	CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEMP.	TEST CONDITIONS
A-5 A-2 A-4	INPUT OFFSET VOLTAGE	ΔV_{in}		1.0	4.0 3.0 4.0	mV mV mV	-55°C +25°C +125°C	$V_4 = 1.0V$, $V_9 = 0V$, Note 5
C-1	VARIATION OF INPUT OFFSET VOLTAGE WITH TEMPERATURE	$\Delta\lvert\Delta V_{in}\rvert$			1.5 1.5	mV mV	-55°C +125°C	Note 7
C-1 A-2	INPUT BIAS CURRENT	I_{in}		28	70 35	µA µA	-55°C +25°C	$V_8 = V_9 = 0V$
C-1 A-2	INPUT OFFSET CURRENT	ΔI_{in}		2.0	12 6.0	µA µA	-55°C +25°C	$V_8 = V_9 = 0V$
A-6	TURN ON DELAY TIME	t_{d_1}		40	50	ns	+25°C	Notes 3, 4
A-6	RISE TIME	t_r		12	20	ns	+25°C	Notes 3, 4
A-6	TURN OFF DELAY TIME	t_{d_2}		40	50	ns	+25°C	Notes 3, 4
A-6	FALL TIME	t_f		25	35	ns	+25°C	Notes 3, 4
	OPEN LOOP BANDWIDTH (-3db)	BW		5.0		MHz	+25°C	
A-5 A-7 A-4	OPEN LOOP VOLTAGE GAIN	A_{Vo}	1200 1600 1600	2100		V/V V/V V/V	-55°C +25°C +125°C	
A-5 A-2 A-4	OUTPUT VOLTAGE SWING (Positive)	$V0_{HI}$	4.6 4.9 4.9	5.1		V V V	-55°C +25°C +125°C	$V_8 = -0.1V$, $V_9 = 0V$
A-5 A-2 A-4	OUTPUT VOLTAGE SWING (Negative)	$V0_{Lo}$	-1.5 -1.2 -0.8	-1.4		V V V	-55°C +25°C +125°C	$V_8 = 0.1V$, $V_9 = 0V$
	OUTPUT IMPEDANCE	Z_{OUT}		50		Ω	+25°C	f ≤10KHz
A-2	OUTPUT SINK CURRENT	I_o^-	2.2	2.8		mA	+25°C	$V_8 = 0.1V$, $V_9 = 0V$, $R_L = 150\Omega$, Note 2
A-2	OUTPUT SOURCE CURRENT	I_o^+	-18	-20		mA	+25°C	$V_8 = -0.1V$, $V_9 = 0V$, $R_L = 150\Omega$, Note 2
A-7	STROBE ON CURRENT	$I0_I$		-3.8	-4.6	mA	+25°C	$V_5 = V_9 = 0V$, $V_8 = -0.1V$
A-4	STROBE LEAKAGE CURRENT	$I1_I$		1.0	10	µA	+125°C	$V_5 = 6.0V$, $V_8 = 0.1V$, $V_9 = 0V$
	DIFFERENTIAL INPUT IMPEDANCE	Z_{IN}		2000		Ω	+25°C	f ≤10KHz
	COMMON MODE REJECTION RATIO	CMRR		80		db	+25°C	Note 6
A-2	POWER SUPPLY CURRENT	I^+, I^-		19	25	mA	+25°C	$V_8 = V_9 = 0V$

Notes:

(1) All voltages are referenced to Pin 7. Pin 1 is connected to case.
(2) R_L must be connected between Pins 4 and 7. Output sink current capability may be increased up to 10mA by connecting an external resistor between Pins 1 and 3.
(3) Differential Overdrive Voltage = 10mV.
(4) t_{d1} and t_{d2} are measured from 80% point of input pulse to 20% point of output pulse. t_r and t_f are measured from 20% to 80% points of output pulse.
(5) Input offset voltage may be (+) or (-), Pin 8 with respect to Pin 9.
(6) Measured at a common mode voltage of +1.0VDC.
(7) Variation from room temperature value.
(8) See Signetics Bulletin No. 5001 for details of acceptance tests under Signetics SURE Program. Sub-group A-7 is used for the electrical end points for Linear Products.
(9) Positive current flow is defined as into the terminal referenced.
(10) Precautionary measures should be taken to ensure current limiting in accordance with maximum ratings should the isolation diodes become forward biased.

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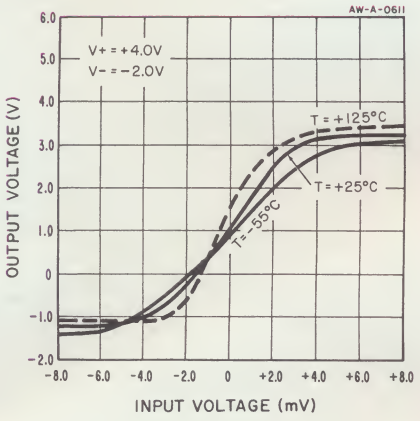
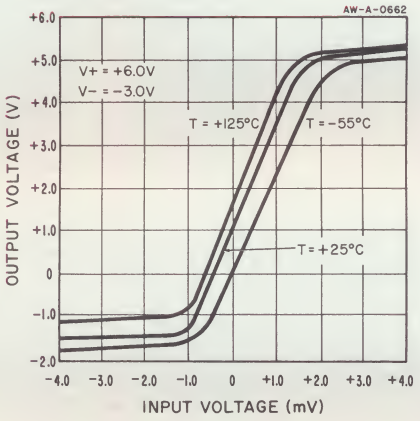
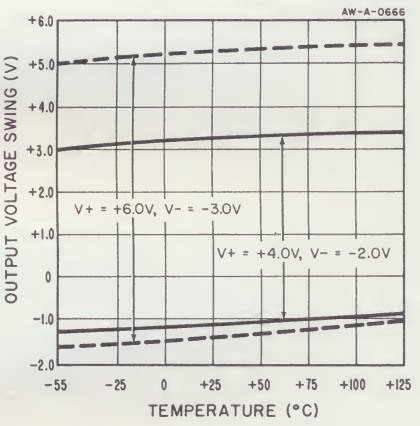
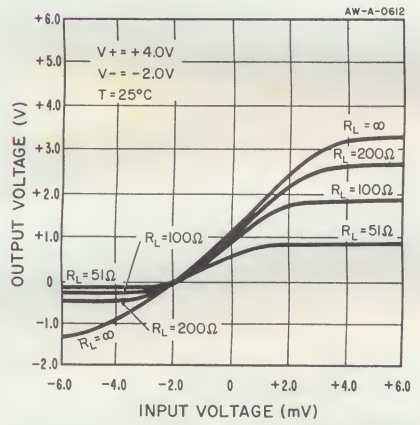
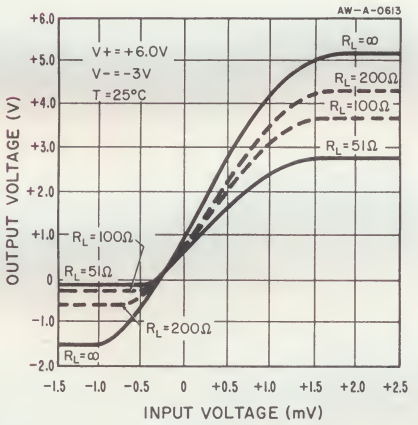
TYPICAL CHARACTERISTICS

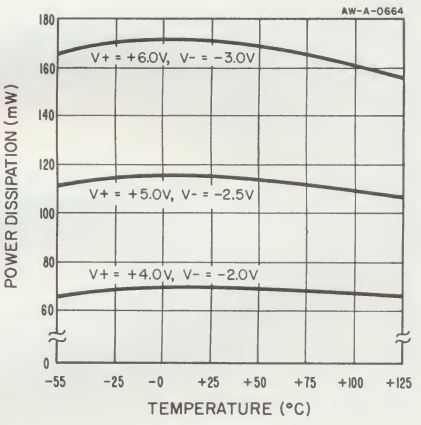


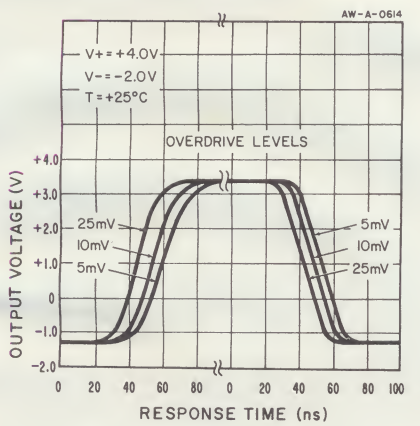


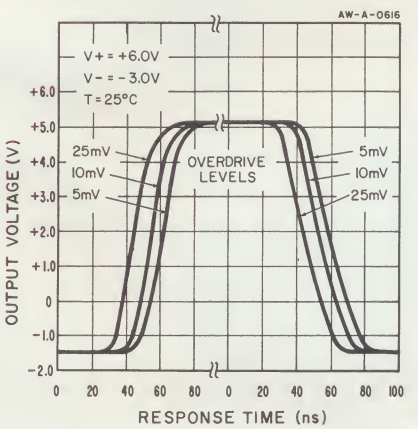


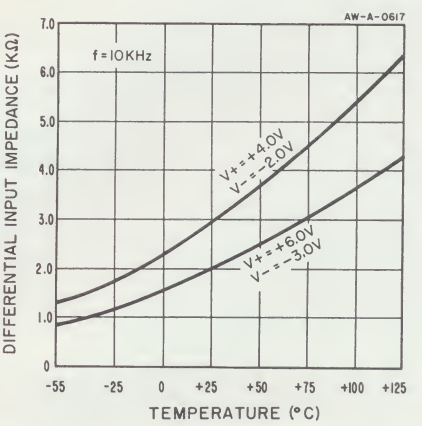




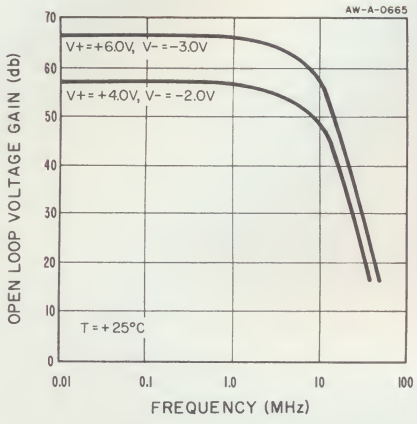


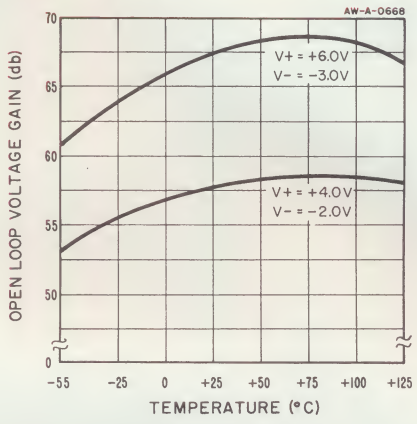


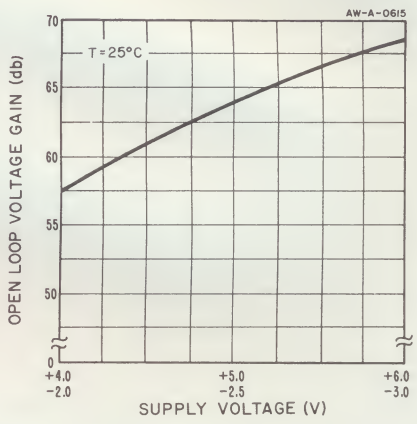


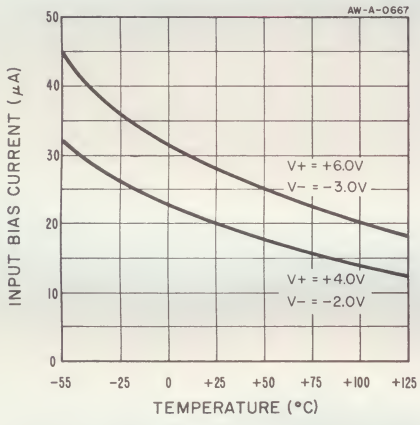


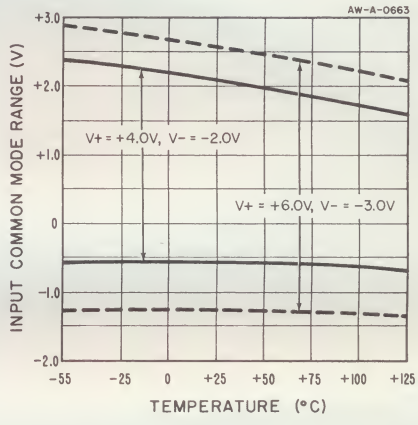
TYPICAL CHARACTERISTICS (Cont'd)











SE518 fan-out for typical DTL loads is one, however, provision is made for increasing the current sinking capability by connecting an external resistor between Pins 1 and 3. The value of this resistance (R_{ext}) for any sinking current up to 10mA, may be determined from the following equation:

$$R_{(ext)} = \frac{V_{1,3} - .026 \ln \frac{I_S'}{I_S}}{I_S - \left[\frac{V_{1,3} - .026 \ln \frac{I_S'}{I_S}}{R_{1,3}}\right]}$$

Where:

I_S = the non-adjusted sink current

I_S' = desired sink current

$R_{1,3}$ = the internal resistance of the device, measured between Pins 1 and 3 of the device.

$V_{1,3}$ = the voltage measured between Pins 1 and 3, (typically 0.4 volts at $V^+ = 4$ volts, $V^- = 2$ volts and 0.56 volts at $V^+ = 6$ volts; $V^- = 3$ volts).

VOLTAGE COMPARATOR

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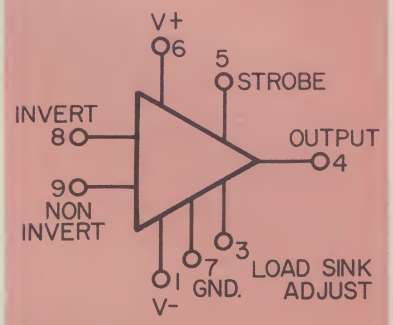
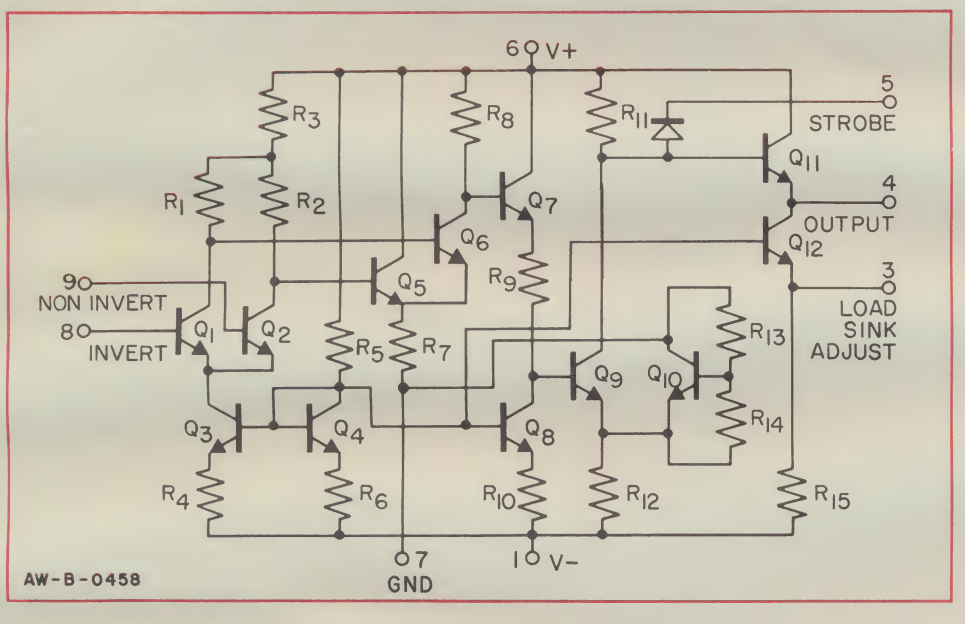


The Signetics NE518 is a medium-gain, high frequency differential amplifier fabricated within a monolithic silicon substrate by planar and epitaxial techniques It is designed for voltage comparator, sense amplifier and general broadband amplifier applications. Its superior current sinking and current sourcing capabilities make it ideal for driving digital circuitry. The NE518 is designed to operate over the temperature range of 0°C to +70°C and is guaranteed to meet or exceed all environmental requirements of MIL-S-19500D and MIL-STD-750.

FEATURES

- STROBE CONTROL
- ADJUSTABLE CURRENT SINK
- RESPONSE TIME = 60ns
- INPUT OFFSET VOLTAGE = 1.0mV
- OPEN LOOP GAIN = 1800
- OUTPUT IMPEDANCE = 50Ω
- BANDWIDTH = 5.0MHz

CIRCUIT SCHEMATIC

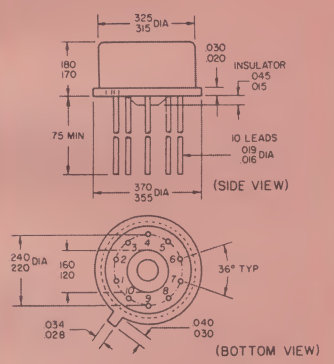


ABSOLUTE MAXIMUM RATINGS

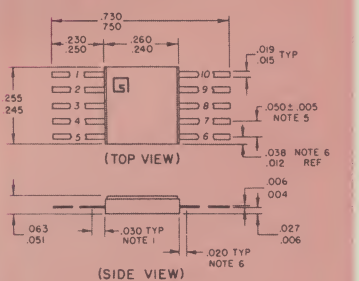
VOLTAGE APPLIED (Positive)	+8.0V
VOLTAGE APPLIED (Negative)	-4.0V
VOLTAGE APPLIED (Input)	±5.0V
POWER CONSUMPTION	300mW
POWER SUPPLY CURRENT RATING	-25mA
OUTPUT SOURCE CURRENT	20mA
STORAGE TEMPERATURE	-65°C to +150°C
OPERATING TEMPERATURE	0°C to +70°C

Maximum ratings are limiting values above which serviceability may be impaired.

K-PACKAGE (TO-100)



G-PACKAGE (TO-91)
(MODULAR GLASS-KOVAR)



NOTES:
(1) Recommended minimum offset before lead bend.
(2) All leads weldable and solderable.
(3) Pin 1 internally connected to case.
(4) All dimensions in inches.
(5) Tolerances are non-cumulative.
(6) Lead spacing dimensions apply to this area only.
(7) Signetics symbol on flat package locates lead No. 1.

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ELECTRICAL CHARACTERISTICS (NOTE 1) Standard Conditions: V+ = +6.0V, V– = –3.0V

ACCEPTANCE TEST SUB-GROUP	CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEMP.	TEST CONDITIONS
A-5	INPUT OFFSET VOLTAGE	ΔV_{in}			4.0	mV	0°C	V_4 = 1.0V, V_9 = 0V, Note 5
A-2				1.0	3.5	mV	+25°C	
A-4					4.0	mV	+70°C	
C-1	VARIATION OF INPUT OFFSET VOLTAGE WITH TEMPERATURE	$\Delta\lvert\Delta V_{in}\rvert$			1.0	mV	+0°C	Note 7
					1.0	mV	+70°C	
C-1	INPUT BIAS CURRENT	I_{in}			70	µA	0°C	$V_8 = V_9$ = 0V
A-2				35	50	µA	+25°C	
C-1	INPUT OFFSET CURRENT	ΔI_{in}			12	µA	0°C	$V_8 = V_9$ = 0V
A-2				3	9	µA	+25°C	
A-6	TURN ON DELAY TIME	t_{d_1}		45	60	ns	+25°C	Notes 3, 4
A-6	RISE TIME	t_r		15	25	ns	+25°C	Notes 3, 4
A-6	TURN OFF DELAY TIME	t_{d_2}		45	60	ns	+25°C	Notes 3, 4
A-6	FALL TIME	t_f		30	40	ns	+25°C	Notes 3, 4
	OPEN LOOP BANDWIDTH (-3db)	BW		5.0		MHz	+25°C	
A-5	OPEN LOOP VOLTAGE GAIN	A_{VO}	1200			V/V	0°C	
A-7			1375	1800		V/V	+25°C	
A-4			1375			V/V	+70°C	
A-5	OUTPUT VOLTAGE SWING (Positive)	$V0_{HI}$	4.6			V	0°C	V_8 = -0.1V, V_9 = 0V
A-2			4.8	5.0		V	+25°C	
A-4			4.8			V	+70°C	
A-5	OUTPUT VOLTAGE SWING (Negative)	$V0_{LO}$	-1.5			V	0°C	V_8 = +0.1V, V_9 = 0V
A-2			-1.2	-1.4		V	+25°C	
A-4			-0.8			V	+70°C	
	OUTPUT IMPEDANCE	Z_{OUT}		50		Ω	+25°C	f ≤ 10KHz
A-2	OUTPUT SINK CURRENT	I_{0^-}	2.2	2.8		mA	+25°C	V_8 = +0.1V, V_9 = 0V, R_L = 150Ω, Note 2
A-2	OUTPUT SOURCE CURRENT	I_{0^+}	-15	-18		mA	+25°C	V_8 = -0.1V, V_9 = 0V, R_L = 150Ω, Note 2
A-7	STROBE ON CURRENT	$I0_I$		-4.0	-4.75	mA	+25°C	$V_5 = V_9$ = 0V, V_8 = -0.1V
C-1	STROBE LEAKAGE CURRENT	$I1_I$		1.0	10	µA	+70°C	V_5 = 6.0V, V_8 = +0.1V, V_9 = 0V
	DIFFERENTIAL INPUT IMPEDANCE	Z_{IN}		1400		Ω	+25°C	f ≤ 10KHz
	COMMON MODE REJECTION RATIO	CMRR		80		db	+25°C	Note 6
A-2	POWER SUPPLY CURRENT	I^+, I^-		19	27	mA	+25°C	$V_8 = V_9$ = 0V

Notes:

(1) All voltages are referenced to Pin 7. Pin 1 is connected to case.
(2) R_L must be connected between Pins 4 and 7. Output sink current capability may be increased up to 10mA by connecting an external resistor between Pins 1 and 3.
(3) Differential Overdrive Voltage = 10mV.
(4) t_{d1} and t_{d2} are measured from 80% point of input pulse to 20% point of output pulse. t_r and t_f are measured from 20% to 80% points of output pulse.
(5) Input offset voltage may be (+) or (-), Pin 8 with respect to Pin 9.
(6) Measured at a common mode voltage of +1.0VDC.
(7) Variation from room temperature value.
(8) See Signetics Bulletin No. 5001 for details of acceptance tests under Signetics SURE Program. Sub-group A-7 is used for the electrical end points for Linear Products.
(9) Positive current flow is defined as into the terminal referenced.
(10) Precautionary measures should be taken to ensure current limiting in accordance with maximum ratings should the isolation diodes become forward biased.

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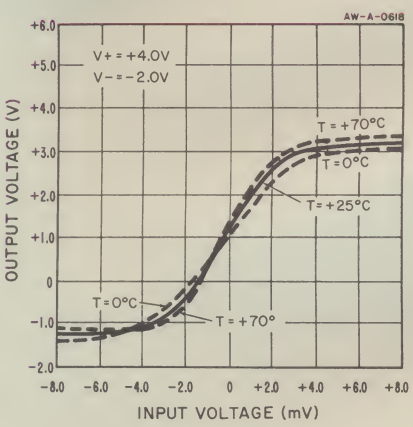
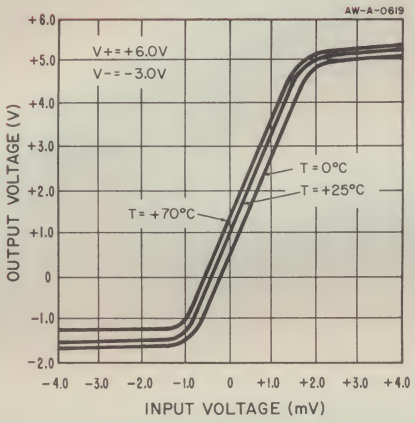
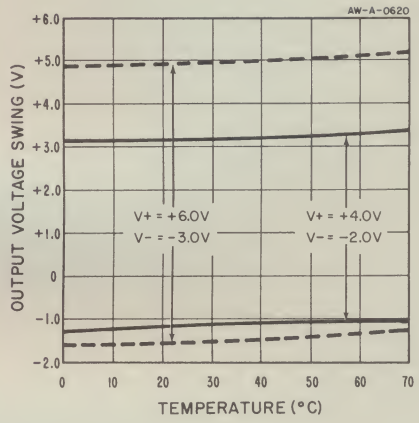
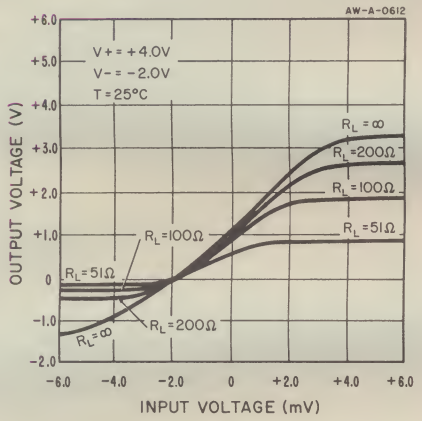
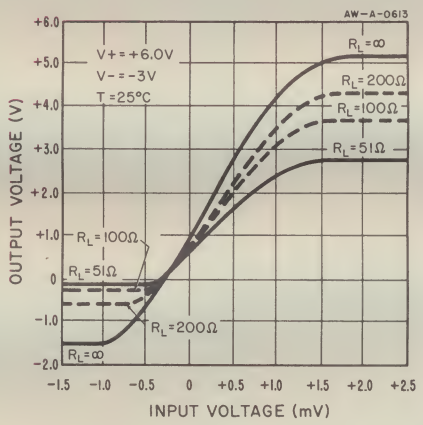
TYPICAL CHARACTERISTICS

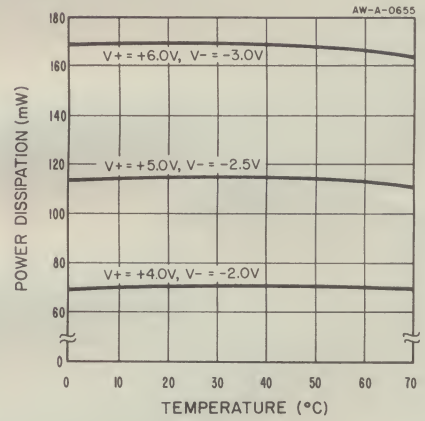


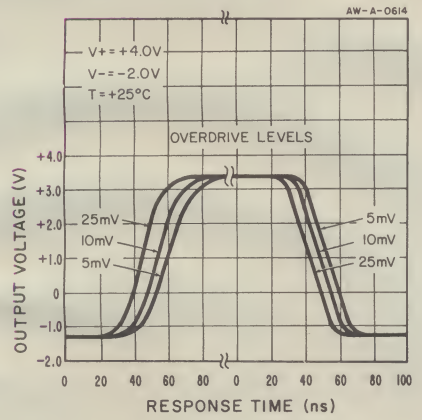


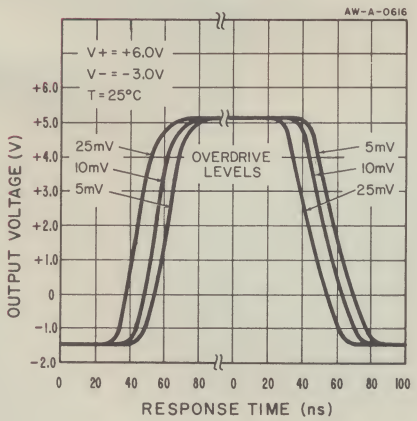


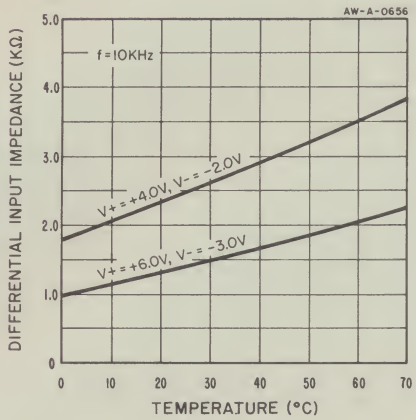




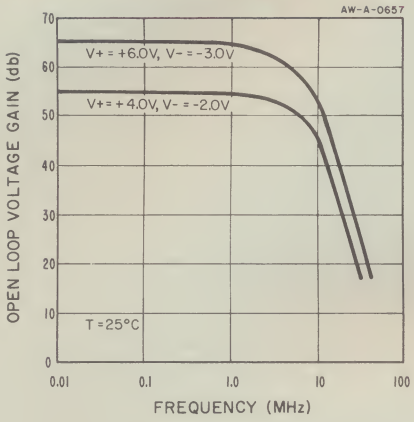


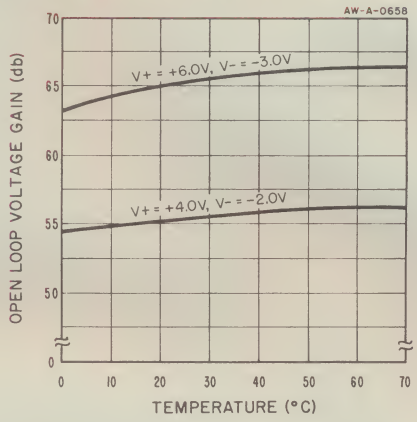


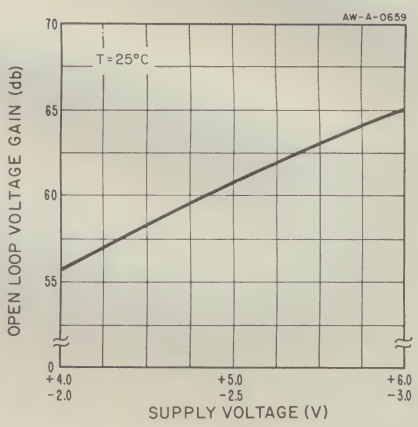


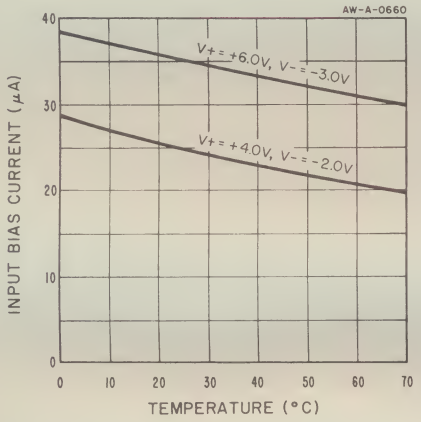


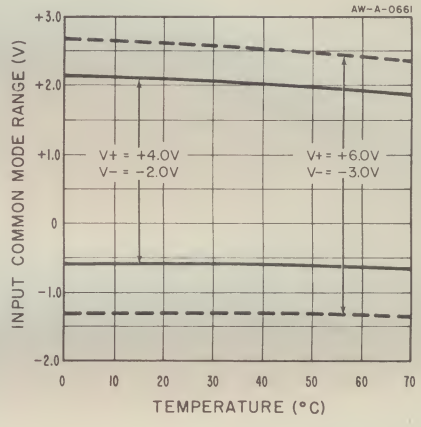
TYPICAL CHARACTERISTICS (Cont'd)











NE518 fan-out for typical DTL loads is one, however, provision is made for increasing the current sinking capability by connecting an external resistor between Pins 1 and 3. The value of this resistance (R_{ext}) for any sinking current up to 10mA, may be determined from the following equation:

$$R_{(ext)} = \frac{V_{1,3} - .026 \ln \frac{I_S'}{I_S}}{I_S - \left[\frac{V_{1,3} - .026 \ln \frac{I_S'}{I_S}}{R_{1,3}}\right]}$$

Where:

I_S = the non-adjusted sink current

I_S' = desired sink current

$R_{1,3}$ = the internal resistance of the device, measured between Pins 1 and 3 of the device.

$V_{1,3}$ = the voltage measured between Pins 1 and 3, (typically 0.4 volts at $V^+ = 4$ volts, $V^- = 2$ volts and 0.56 volts at $V^+ = 6$ volts; $V^- = 3$ volts).